

RAJASTHAN UNIVERSITY
Note on the results of Diet Surveys.

By

W. R. AYKROYD, M. D., Sc. D.,

Director,

Nutrition Research Laboratories, I. R. F. A., Coonoor, S. India.

Over 50 surveys have now been carried out in various parts of India which provide information about the diets actually consumed by groups of families and indicate the changes in food production and consumption which are desirable to improve the diet of the population. A good deal of this material has been published in scientific journals, but no comprehensive report has as yet been prepared.

The surveys have been carried out in the following way: a careful quantitative investigation is made of *all* the foods consumed by a group of families—usually about 20—the survey lasting 10-20 days. This involves daily house to house visits in which all foodstuffs are weighed. Surveys have sometimes been repeated in the same area at different seasons. Intake per consumption unit (i.e. per adult man value) of calories, protein, various mineral elements and vitamins is worked out and, in addition, the average composition of the diets as regards actual foodstuff's determined. It is the latter which is of the greatest value in connection with agricultural policy.

Table 1 shows the intake of important groups of foodstuffs as determined in various surveys. In the case of certain surveys the data obtained have not yet been fully worked up. Further surveys are in progress in new areas. The information already available does, however, provide a picture of dietary habits over a large part of India. Most of the families investigated belonged to the poorer classes and their diet is typical of that consumed throughout the year by millions in the areas in which the surveys were carried out. It is to be observed that while the kinds of pulses, vegetables, etc., taken naturally differ from place to place, in general the nutritive value of different varieties coming under the various headings is fairly similar. Thus, leafy vegetables as a group are rich in vitamin A and calcium, all vegetable fats and oils consumed in India are devoid of vitamin A activity, and so on. Any differences in the nutritive value of different varieties of the supplementary foodstuffs, which are usually included in the diet in very small quantities, are unimportant in relation to the diet as a whole. The method of grouping adopted thus gives a reasonably accurate idea of Indian diets and their nutritive value.

This note was prepared for the meeting of the Nutrition Advisory Committee, Indian Research Fund Association, which was held in New Delhi in December, 1939. The Committee recommended that the existing information about the foodstuff composition of diets should be made available for agricultural and animal husbandry departments and utilised as a guide to agricultural policy.

Table 1. Diet Surveys.

Province or State			M A D R A S		
District	Chingleput	Trichinopoly District.		Nilgiris	Madras City Saidapet
		Mayanur.			
	1	2 <i>a</i>	2 <i>b</i>	3	4 <i>a</i>
Urban or rural	Rural	Rural	Rural	Rural	Urban
No. of families	12	32	25	16	14
No. of persons		274	129	90	83
No. of days of survey	20	20 July, August	15-20 February	7 June	18-20
Season	January				January
Economic status, etc.	Cultivators & labourers	Small cultivators		Tea plantation labourers	Weavers. Leprosy in 13 families

FOODSTUFFS: Ozs. per consumption unit per day.						
Rice	15	10	14	18	14.2	
Wheat	...	...	...	...	...
Millets	2	9	6	...	...
Other cereals	...	...	-	...	...
Pulses	0.5	1.4	1.4	1.0	0.9	
Leafy vegetables.	0.3	0.3	0.3	...	0.6	
Non-leafy vegetables	0.9	1.5	3.4	3.0	2.8	
Fruit	...	...	...	0.1	0.1	
Ghee	...	...	...	...	...
Vegetable oils	0.1	0.6	0.5	0.4	0.5	
Milk and butter-milk	...	...	...	...	1.1	
Meat, fish and eggs	0.8	0.1	0.2	...	1.5	
Sugar and jaggery	...	...	...	...	...

Source: 1. & 2*a* Aykroyd & Krishnan (1937) I. J. M. R., * 24, p. 667.
 2*b* Aykroyd & Krishnan (1937) I. J. M. R., 25, p. 1.
 3. Krishnan (1939) I. J. M. R., 26, p. 901.
 4*a* Aykroyd & Krishnan (1939) I. J. M. R., 26, p. 897

N. B.—All the diets included condiments and spices in small quantities.

*I. J. M. R.—Indian Journal of Medical Research

3
Table 1. Diet Surveys (*contd.*)

Province or State.			MADRAS.	TRAVAN-CORE.	MYSORE,	HYDER-ABAD.		
District	...	...	Madras City Saidapet Mambalam	Oollanoor	Closepet.	Hyderabad City-Dn.		
			4b	4c	5	6a	6b	7
Urban or rural	...	Urban	Semi-urban.	Rural.	Rural.	Rural.	Urban.	
No. of families	...	25	20	9	27	32	22	
No. of persons	...	144	110	47	203	232	...	
No. of days of survey	...	20	20	10	20	20	10	
Season	...	July	July	January	July, August	June, July	February	
Economic status, etc.	...	Weavers, leprosy in 16/25 families.	Labourers	Small cultivators	Small cultivators	Small cultivators	Labourers	

FOODSTUFFS: Ozs. per consumption unit per day.								
Rice	...	15.5	16.3	9	2.4	1.7	14.6	
Wheat	...	...	...	...	...	...	...
Millets	...	...	...	...	24.9	24.2	9.5	
Other cereals	...	...	...	18 (tapioca)	...	...	...
Pulses	...	1.25	0.75	1	2.1	1.5	1.1	
Leafy vegetables	...	1.0	0.2	...	1.3	0.5	1.7	
Non-leafy vegetables	...	2.5	1.8	8 (75% yam)	0.9	0.8	0.7	
Fruit	...	...	...	5	...	...	...
Ghee	...	...	...	...	...	0.1	...	
Vegetable oils	...	0.5	...	1.1	0.1	0.1	0.2	
Milk and butter-milk	...	3.7	...	2	1.9	1.0	...	
Meat, fish and eggs	...	0.7	0.9	1.5	...	...	0.13	
Sugar and jaggery	...	...	...	...	...	...	...

Source : 4b Aykroyd & Krishnan (1939) I. J. M. R., 26, p. 897.

4c Nutrition Research Laboratories (unpublished.)

5 Krishnan (1939) I. J. M. R., 26, p. 901.

6a & 6b Nutrition Res. Labs. & Health Unit, Closepet (unpublished.)

7 Shourie & Wilson D. C. (unpublished.)

N.B.—All the diets included condiments and spices in small quantities.

Table 1. Diet Surveys (*contd.*)

Province or State.	CENTRAL PROVINCES.			ORISSA.					
	District	...	...	Raipur.	Cuttack.	Puri.	Puri.	Puri.
				8	9	10a	10b	11a	11b
Urban or rural	Rural	Urban	Urban	Urban		Rural	Rural	
No. of families	about 25.	63			33			
No. of persons			163			
No. of days of survey	...	20	18			7—10			
Season	...	December	January		January and February.				
Economic status, etc.	...	Agriculturists.	...	Tradesmen, etc. (relatively well-to-do.)	Labourers, fisher- men, etc.	Agricul- turists free from leprosy.	Agricul- turist families with leprosy.		
FOODSTUFFS: Ozs. per consumption unit per day.									
Rice	...	26.4	18.9	16	17	24.6		21.1	
Wheat	...	0.2	0.6	2.0	...	...		...
Millets	
Other cereals	
Pulses	...	1.1	1.0	1.5	0.9	0.9		0.6	
Leafy vegetables	...	1.5	1.4	2.0	0.9	0.3		0.4	
Non leafy vegetables	...	3.1	5.8	8.7	1.9	7.7		6.0	
Fruit	...	0.1	...	...	...	...		...
Ghee	0.2	...	...		...
Vegetable oils	...	0.2	0.3	0.6	0.2	0.1		0.1	
Milk and butter-milk	...	0.2	0.3	6.5	...	...		...
Meat, fish and eggs	...	0.1	0.6	1.5	1.4	0.6		1.1	
Sugar and jaggery	

Source: 8 Narindra Singh & Wilson, D. C. (unpublished)

9 Narindra Singh & Wilson, D. C. (unpublished.)

10a, 10b, } 11a, 11b, } Narindra Singh, (1939) I. J. M. R., 27, p. 453.

Table 1. Diet Surveys (*Contd.*)

Province or State		B E N G A L			
District	...	Calcutta	Calcutta	Basarat	Dinajpore
		12	13	14	15
Urban or rural	...	Urban	Urban	Rural	Rural
No. of families	...	5	7	10	40
No. of persons	...	48	...	79	...
No. of days of survey	...	7	21	7	21
Season	...	...	June	...	January and February.
Economic status, etc.	...	Middle class families earning Rs. 200-500/- p.m.	Marwari families Business and professional people earning Rs. 100-1000 p.m.	Agriculturists dependent on their own land.	Small agriculturists

FOODSTUFFS: Ozs. per consumption unit per day.

Rice	...	10.2	3.0	23.7	25.0
Wheat	...	3.1	10.3	...	...
Millets	...	...	...	...	...
Other cereals	...	...	...	...	...
Pulses	...	1.5	2.4	1.4	0.4
Leaf vegetables	...	0.7	....	0.8	0.2
Non-leafy vegetables	...	11.6	6.2	9.2	7.0
Fruit	...	3.3	3.1	0.6	...
Ghee	...	...	2.0	...	...
Vegetable oils	...	2.2	...	0.6	0.3
Milk and butter-milk	...	11.0	11.7	3.1	...
Meat, fish and eggs	...	5.6	...	1.8	0.7
Sugar and jaggery	...	...	0.6	...	...

Source: 12 Wilson, H. E. C. & Mitra, D. D. (1938) I. J. M. R., 26, p. 131.

13 Mitra, D. D. (1939) I. J. M. R., 27, p. 441.

14 Wilson, H. E. C. & Mitra, D. D. (1938) I. J. M. R., 26, p. 131.

15 Mitra, D. D. (1939) I. J. M. R., 27, p. 441,

Table 1. Diet Surveys (*Contd.*)

Province or State	ASSAM			BIHAR			
	District	Cachar	Jorebaut	Jamshedpur			
		16	17	18a	18b	18c	18d
Urban or rural	...	Rural	Rural	Urban	Urban	Urban	Urban
No. of families	...	37	35	110	35	19	13
No. of persons			845	
No. of days of survey	...	21	21			15	
Season	March and April			July and August	
Economic status, etc.	...	Industrial labourers earning Rs. 8-10 p.m.	Tea plantation labourers.	Industrial workers earning up to			
				Re. 1/- per day.	Rs. 1/8 per day.	Rs. 3/- per day.	Over Rs.3/- per day.

FOODSTUFFS: Ozs. per consumption unit per day.

Rice	...	...	19.0	19.4	23.9	24.4	22.1	21.0
Wheat	...	...	..	...	...	...	...	...
Millets	...	...	...	...	...	...	...	...
Other cereals	...	...	...	...	...	...	...	...
Pulses	...	...	1.0	0.9	2.4	3.1	3.8	3.4
Leafy vegetables	...	0.2	0.8	1.2	1.0	0.3	0.1	
Non-leafy vegetables	...	3.4	4.4	2.3	2.7	5.5	6.2	
Fruit	...	...	...	0.1	0.3	0.9	0.9	
Vegetable oils including ghee	...	(no ghee)	(no ghee)					
Milk and butter-milk	...	0.5	...	0.5	1.4	2.6	5.7	
Meat, fish and eggs	...	0.2	0.7	0.6	0.7	1.3	1.0	
Sugar and jaggery	...	...	...	0.2	0.3	0.7	0.6	

Source: 16 Wilson, H. E. C. & Mitra, D. D. (1938) I. J. M. R., 26, p. 131.

17 Mitra, D. D. (1939) I. J. M. R., 27, p. 441.

18a, b, c, and d, Mitra, K. (1940) I. J. M. R. (in press).

Table 1. Diet Surveys (*Contd.*)

Province or State		BIHAR (Santal Parganas)						
District	...	Bhaga village.	Mahul- bana, Amui.	Kushira, Amrapara	Mahulbanana.		Gomo- pahar, Borophar, Chognidih, Amar jwala.	Jalokuri, Chota- pakharia, Sidhghat.
		19a	19b	19c	19d	19e	19f	19g
Urban or rural ...		Rural	Rural	Rural	Rural	Rural	Rural	Rural
No. of families ...		52	36	38	7	5	39	44
No. of persons ...		279	198	209	27	23	214	213
No. of days of survey ...		10	10	10	10	10	10	10
Season	...	October to January						
Economic status etc. ...		Aboriginal tribes practicing agriculture.						
Santal	Santal	Santal	Mahali	Dom	Malpahari	Sauria- pahari.		
FOODSTUFFS: Ozs. per consumption unit per day.								
Rice	...	16.2	20.1	19.3	20.4	18.4	13.1	14.9
Wheat	...	..	..	..	..	..	..	..
Millets	...	..	..	..	..	..	..	..
Other cereals	...	..	..	..	..	..	..	..
Pulses	...	0.4	0.6	0.2	0.8	1.1	0.5	3.9
Leafy vegetables		2.0	2.0	1.6	1.6	0.3	0.9	0.4
Non-leafy	"	0.5	0.5	0.8	0.7	0.5	0.3	0.2
Fruit	...	..	..	..	..	..	..	..
Ghee	...	..	..	..	..	..	..	..
Vegetable oils	...	..	0.1	..	0.2	..	..	0.1
Milk and butter-milk	...	0.2	0.1	..	..	..	..	..
Meat, fish and eggs	..."	0.2	0.1	..	0.4	..	..	..
Sugar and Jaggery	....	..	..	..	..	..	..	..

Source: 19a, b, c, d, e, f, & g. Mitra, K. (unpublished).

Table 1. Diet Surveys (*Contd.*)

Province or State	DELHI PROVINCE			TEHRI-GARHWAL STATE KASH (United Provinces) MIR		
	District	...	...	Najafgarh.	Barkot	Narendranagar.
				20a	20b	20c
					21a	21b
Urban or rural	...	Rural	Semi-urban	Rural	Rural	Rural
No. of families	...	25	10	14	20	20
No. of persons	...	85	45	82	...	..
No. of days of survey	...	6	14	10	10	10
Season	...	December	January	February	July and August	October
Economic status, etc	..	Labourers engaged on road making on 4-8 annas per day.	Small tradesmen earning Rs. 8-30 p.m.	Cultivators living on their own land.	Cultivators Area in which leprosy is common.	Cultivators Area in which leprosy is rare.

FOODSTUFFS: Ozs. per consumption unit per day.

Rice	...	...	...	...	...	15.6	6.8	25.6
Wheat	...	...	26.5	10.9	2.5	0.7	17.0	1.3
Millets	...	...	2.1	5.8	18.2	...	...	...
Other cereals	...	...	...	2.8	2.5	3.9	...	...
Pulses	...	...	8.4	4.2	2.6	1.8	2.4	0.6
Leafy vegetables	...	2.4	2.0	1.5	0.5	1.6	5.2	
Non-leafy vegetables	...	0.5	3.0	0.5	4.7	2.3	1.5	
Fruit	...	...	...	...	...	...	...	...
Ghee	...	...	...	0.3	0.5	...	0.4	...
Vegetable oils	...	...	...	...	...	0.2	0.1	0.9
Milk and butter-milk	...	...	5.7	13.9	0.9	6.4	2.2	
Meat, fish and eggs	...	...	...	...	...	...	...	0.2
Sugar and jaggery	...	1.5	1.5	0.4	...	0.2	0.5	

Source: 20a, b, & c. Shourie (1939) I. J. M. R., 26, p. 907.

21a, & b. Narindra Singh (unpublished).

22 Shourie, and Wilson, D. C. (unpublished).

Table 1. Diet Surveys (*Contd.*)

Province or State			BARODA		PUNJAB			
District	...	...	Nawsari District.	Ferozepore.				Sialkot
			23	24a	24b	24c	24d	25
Urban or rural ...	...	Rural	Rural	Urban	Urban	Urban	Urban	Urban and rural. 120
No. of families ...	...	9	16	19	8	8	7-10	...
No. of persons ...	...	55			245			
No. of days of survey	...	14	7-10	7-10	7-10			
Season	...	February and March		April and May				
Economic status, etc.	...	Small cultivators.	Middle class Hindus.	Middle class Mohammedens.	Middle class Sikhs.	Sweepers.		Full details not yet available.
FOODSTUFFS: Ozs. per consumption unit per day.								
Rice	...	8.1	...	...	...	...	...	2.4
Wheat	...	...	17.4	19.8	17.8	22.4		13.5
Millets	...	11.3	...	...	...	...	...	0.2
Other cereals	...	...	...	...	...	...	...	1.9
Pulses	...	4.0	1.9	1.0	1.0	2.7		1.6
Leafy vegetables	...	...	4.6	5.1	4.2	3.3		3.4
Non-leafy vegetables	...	2.6	4.6	5.1	4.2			3.3
Fruit	...	...	2.5	1.6	1.0	0.0		0.4
Ghee	...	0.3	1.2	1.3	1.5	0.4		1.0
Vegetable oils	...	0.4	...	...	...	...		0.1
Milk and butter-milk	...	2.3	8.7	7.8	12.3	2.4		8.3
Meat fish and eggs	...	...	0.0	1.5	0.1	0.7		0.6
Sugar and jaggery	...	...	...	...	...	...		3.3

Source: 23 Pendse (unpublished).
 24a, b, c, d, d, Ahmad and Gore (1938) I. J. M. R., 26, p. 155.
 25 Wilson, D. C. (unpublished).

Table 1. Diet Surveys (Contd.)

Province or State		P U N J A B					
District.		KANGRA VALLEY					
		Launa.	Thari	Launa.	Gorra.	Chilali	Bhadwar.
		26a	26b	27a	27b	27c	27d
Urban or rural ...	...	Rural	Rural	Rural	Rural	Rural	Rural
No. of families ...	...		19		15	15	15
No. of persons ...	...			87	80	97	108
No. of days of survey	...	28	28	28	28	28	28
Season	...	April to October					
Economic status, etc.	...	Agriculturists and casual labourers.					

FOODSTUFFS: Ozs. per consumption unit per day.							
Rice	...	...	14.9	3.1	14.4	15.4	0.4
Wheat	...	...	5.6	0.2	7.4	10.8	18.2
Millets	...	...	...	...	...	...	...
Other cereals ... (Chiefly maize)	...	6.2	23.9	1.1	0.9	8.7	6.4
Pulses	...	1.7	2.7	0.9	1.8	1.8	2.1
Leafy vegetables.	...	0.6	0.2	0.4	0.9	...	...
Non-leafy vegetables	...	1.9	0.8	0.7	1.2	1.5	1.9
Fruit	...	...	...	...	...	...	...
Ghee	...	...	...	...	0.1	...	0.2
Vegetable oils	...	0.3	0.1	0.1	0.2	...	0.1
Milk and butter-milk	...	1.6	3.4	0.8	4.0	1.7	2.2
Meat, fish and eggs	...	0.5	0.1	0.1	0.1	...	0.1
Sugar and jaggery	...	0.6	0.1	0.1	0.1	...	0.1

Source: 26a & b. Shourie, and Wilson D.C. (unpublished).

27a, b, } Punjab Public Health Department—Report on an Inquiry into the State
c, d, } of Nutrition and Health in the Kangra Valley, 1939.

N.B.—All the diets included condiments and spices in small quantities.

Table 1. Diet Surveys (*Contd.*)

Province or State		B O M B A Y			
District ...		BOMBAY CITY			
		28a	28b	28c	28d
Urban or rural	...	Urban	Urban	Urban	Urban
No. of families	...	10	10	10	10
No. of persons	...	53	40	37	51
No. of days of survey	...	7	7	7	7
Season	...	...	...	...	...
Economic status, etc, ...		Gujrati families mostly Municipal sweepers with average family income Rs. 36/- p.m.	Deccani families Peons and laboratory assistants with average family income Rs. 40/- p.m.	N. Indian Hindus; Ward-boys, etc, with average family income Rs. 55/- p.m.	Middle class Deccani families mostly clerks with average family income Rs. 135/- p.m.
FOODSTUFFS: Ozs. per consumption unit per day.					
Rice	...	6.5	16.2	2.0	8.2
Wheat	...	7.3	0.1	19.2	3.2
Millets	...	...	...	...	0.2
Other cereals	...	...	...	...	...
Pulses	...	2.4	2.6	2.0	1.1
Leafy vegetables	...	1.0	1.8	0.6	1.8
Non-leafy vegetables	...	3.2	5.7	6.5	3.2
Fruit	...	...	...	...	...
Ghee	...	...	...	0.5	0.9
Vegetable oils	...	0.8	2.1	1.1	2.0
Milk and butter-milk	...	1.5	0.6	1.6	7.6
Meat, fish and eggs	...	0.7	0.9	2.0	4.1
Sugar and jaggery	...	1.6	1.2	1.3	1.9

Source: 28 a, b, c, d. Niyogi and Sukhatankar (1939) I. M. G., 74, p. 674.

THE NATURE OF THE DIETS.

A. Rice diets: The majority of surveys have been carried out in rice-eating areas. The important fact emerges that the diet of the poor rice-eater is very similar all over India. He consumes, in addition to his staple cereal which supplies 80-90 per cent of total calories, only very small quantities of other foods such as pulses, vegetables, fruits and meat. Milk and milk products are taken in negligible quantities or not at all.

The "actual" diet of the poor rice-eater in India is represented semi-diagrammatically in Table 2. A well-balanced diet, resembling diets recommended by the Laboratories, is included for purposes of comparison.

Table 2.

*The "actual" diet of the rice-eater and a "well-balanced" diet
(Ozs. per consumption unit per day.)*

<i>Food.</i>	<i>"Actual" dict.</i>		<i>"Well-balanced" dict.</i>
Rice	15.25	15
Pulses	...	0.5-1.5	3
Milk	None or negligible amounts.	8
Leafy vegetables	0.5-1.0	3.4
Non-leafy vegetables	...	2.0-5.0	6
Fruit	...	negligible	2
Vegetable fats & oils	..	Less than 1.0	2
Fish, meat & eggs	...	0.5-1.0	3 (when milk is absent from the diet or taken in negligible quantities)

(with condiments and spices in small quantities.)

If the composition of the "actual" diet is worked out in terms of protein, minerals and vitamins, and the results compared with the standards suggested by the League of Nations Technical Commission on Nutrition and other standards drawn up by physiologists, it is found that the rice-eater's diet falls short of such standards in almost every important constituent.

Study of the results of the surveys in rice-eating areas and various other investigations carried out within recent years suggests the following:—

- (1) Rice supplies 80-90 per cent of total calories, and the nutritive value of the diet as a whole is in certain respects dependent on that of the main ingredient. Improvement in the nutritive value of rice is therefore desirable. How can this be accomplished? Certain workers

consider that the development, cultivation and popularisation of strains of high nutritive value constitute a promising line of attack. Results so far achieved in this direction do not, however, suggest that any striking success is likely to be obtained by this method of approach. No amount of selective ingenuity could produce a rice which was a rich source of calcium and vitamin A in relation to human requirements. By and large, rice must always be defective in certain essential food elements whatever the botanical variety or method of cultivation. This question has been fully discussed in an I. R. F. A. memoir published from the Laboratories, entitled "The Rice Problem in India." Sir John Russell, in his report on agriculture in India*, has remarked:

"In dealing with food crops intended for home consumption the agriculturist should aim at securing the largest and healthiest crops possible, but he need not concern himself with trying to change their composition. The amount of alteration possible is too small to justify the expenditure of time and resources that can better be spent in other ways."

- (2) On the other hand, the content of rice in certain important food factors is greatly affected by milling, washing, and cooking. The easiest way of raising the nutritive value of rice as consumed is by minimising the losses brought about by these processes. Parboiled rice, which retains certain vitamins in considerable quantities even when highly milled, is to be preferred to raw rice. The problem of ensuring that rice loses as little nutritive value as possible during preparation concerns public health and educational rather than agricultural authorities. It has been fully considered in the memoir referred to.
- (3) Whole wheat and the various millets have a higher nutritive value than milled rice, and the partial substitution of rice by one or other of these foods improves poor rice diets. This has been demonstrated by animal experiments. It is therefore desirable that the consumption of wheat and millet should be encouraged in rice-eating areas. As regards agricultural policy, this presumably means that special attention should be given to increasing the yields and extending the production of these cereals. The cultivation of wheat in India is limited by climatic conditions, but the millets are grown all over the country. They tend, however, to be regarded as secondary in importance to rice, and are often considered to be an inferior type of food. "Grow

*Indian Medical Research Memoir, No. 32, 1940.

* Report on the Work of the Imperial Council of Agricultural Research in applying Science to Crop Production in India, 1937.

and eat more millet" would be a slogan very acceptable to the nutrition worker.

- (4) *Pulses*:—The rice-eater's intake of pulses falls short of what is desirable in the circumstances. Pulses supply some of the food factors in which rice is deficient, and constitute a valuable supplement when the diet is based largely on raw milled rice. Agricultural departments in rice-eating provinces should aim at increasing the cultivation of pulses by developing improved varieties, etc. The type of pulse is not of particular importance, since there is not much difference in the nutritive value of the various species. This question has been dealt with by R. K. Pal.*
- (5) *Milk*:—In the majority of the rice-eating groups investigated, the intake of milk, which of all foods most effectively supplements the poor rice-eater's diet, was negligible, and in striking contrast to the suggested standard of 8 ozs. daily. Wright* has estimated the total milk production of India as amounting to 8 ozs. per capita daily. This figure may, however, give a false impression of the amount of milk consumed in many parts of the country. For practical purposes the poor rice-eater consumes no milk at all. This fact should be generally realised. It follows that every effort must be made to increase the production of milk and milk products.
- (6) *Leafy vegetables*:—Leafy vegetables are particularly valuable supplements to poor rice diets since they are rich in vitamin A, vitamin C and calcium. The surveys have shown that intake is everywhere far below the desirable level. Agricultural departments should therefore take up the study of leafy vegetables and endeavour to increase their production. The commonest and cheapest varieties are usually as valuable as the more expensive.
- (7) *Non-leafy vegetables*:—Intake of non-leafy vegetables showed considerable variation in the different groups. In some it almost reached the standard recommended; in the majority, however it was well below this level. While the value of leafy vegetables must be particularly emphasised, there is no doubt that a greater consumption of vegetables of any kind would improve standards of nutrition in India.

On this point the Russell Report (*loc. cit.*) may be quoted:

* A Review of the Literature of the Nutritive Value of Pulses. 1939. *Ind. Jour. Agric. Sci.*, 9, p. 133.

* Report on the Development of the Cattle and Dairy Industries in India, 1937.

"Much more work should be done on the cultivation of green leafy vegetables and demonstration fruit and vegetable gardens should be set up adjacent to the villages where they can receive manure and water. A marked extension of vegetable growing is very desirable."

Special emphasis may be laid on the development of kitchen gardens in villages. The latter has been strongly recommended by the Nutrition Research Laboratories and is now part of the programme of Health Units, etc., working among village populations. In some places considerable successes have been achieved. The villager in many parts of India is not interested in growing vegetables even when land and water for this purpose are available. Education and propaganda are required to teach him the value of vegetables as food and to persuade him to grow these for his own use when circumstances permit. More attention might be given to vegetable growing by agricultural research workers and departments.

- (8) *Fruits:*—Consumption of fruit was in general negligible in the groups investigated. Fruits are rich in various vitamins which are present in insufficient quantities in the poor rice-eater's diet. Mangoes, papayya, tomatoes and oranges are of particular value. Emphasis may be placed on the tomato, a cheap food of high nutritive quality which is being successfully popularised in certain parts of India.
- (9) *Vegetable oils and fats:*—The rice-eater's diet is normally very poor in fat and intake is often below 20 grammes daily. This is far below the standards of fat intake usually recommended. While it is not clear whether a low consumption of fat tends *per se* to produce ill effects on the body, it is reasonable to suggest that intake of vegetable fats and oils could with advantage be raised. An increased production of oil seeds by selective and other methods is therefore desirable.
- (10) *Fish eggs and meat:*—In general fish is a food of considerable value in supplementing poor rice diets. Fish muscle can supply various important food factors and small fish, when eaten whole, are particularly valuable because they are rich in calcium. The fishing industry in India is in a very backward condition and a large potential source of good food remains untapped. The yield is a mere fraction of that which could be obtained if efficient methods such as those followed in Europe and Japan were applied. The industry is handicapped by the fact that it is almost wholly in the hands of poverty-stricken fishermen who are unable because of ignorance and lack of capital to take advantage of new and improved methods. Problems of transport, refrigeration, marketing, etc., require a great deal of investigation,

It is a pity that at present so little attention should be paid to the development of fisheries because a greater intake of fish would unquestionably do something to improve standards of nutrition in India.

Eggs have a nutritive value roughly similar to that of milk and an increase in production is to be recommended for the same reasons.

Meat forms a very small part of typical Indian diets and in the existing economic circumstances there is little prospect of a material increase in meat supply.

(11) *Sugar and Jaggery*.—The sugar intake of most of the rural rice-eating groups was nil or negligible. The industrial groups in Bihar consumed under 1.0 oz. of sugar daily. The intake of the families in Delhi Province and of the Bombay workers was a little above this level. In South India consumption of sugar and jaggery is in general very small.

These figures suggest that the recent increase in sugar production in India has not as yet been reflected in a substantial intake of sugar on the part of the poorer classes. Sugar is a useful food in that it is a concentrated source of energy; it is, however, pure carbohydrate and does not contain the food factors which are most needed to supplement Indian diets. An increase in sugar intake is no doubt desirable, but it cannot be regarded as highly important from the standpoint of nutrition.

B. *Millet diets*.—So far only one millet eating group (Mysore 6 a, b) has been surveyed. Ragi (*Eleusine coracana*) was the type of millet consumed. A study of the diet, which is probably typical of millet diets throughout India, shows that its composition, apart from the staple cereal, is similar to that of typical rice diets. While millet diets are of higher nutritive value than rice diets because of the superiority of the staple itself, the former can be improved by supplementary foods in sufficient quantities in much the same way as rice diets. The recommendations with regard to milk, vegetables, fruit, etc., thus apply equally to millet diets.

C. *Wheat diets*.—A relatively high intake of milk and milk products and pulses was characteristic of the groups whose chief cereal was wheat. Whole wheat itself is of higher nutritive value than rice as ordinarily consumed, and wheat diets in India are more satisfactory as regards general composition than rice diets. The amount of vegetables and fruit included in the wheat diets shown in Table I was, however, too low. If these diets can be regarded as typical of wheat-eating areas in general, it is clear that a greater

production of vegetables and fruit should be one of the chief aims of agricultural policy in such areas. The low consumption of vegetable oil and meat is offset by the fairly high consumption of milk and ghee, which nevertheless fell short of the standard recommended in certain of the groups.

D. *Tapioca diets*:—Tapioca is consumed as a staple only in Travancore. One survey has been carried out in this State. It was found that the diet of a typical village group was based on both tapioca and rice, the former being consumed in greater quantities. Tapioca has a very low protein content, and in tapioca-eating areas there is a special need for foods rich in proteins of high biological value, such as milk, fish or meat. Intake of vegetables and fruit was found to be satisfactory in the area surveyed. A diet based largely on tapioca should be supplemented by at least 3 ozs. of pulses daily; this quantity was not consumed by the group studied. Most of the tapioca eating areas are adjacent to the coast and advantage should be taken of this to increase fish intake in these areas.

The investigations reported in this note are in line with the following recommendation in the Russell Report (*loc. cit.*)

"The first need in my view is to make a nutrition survey in each province so as to discover what are the chief deficiencies in dietary; the medical authorities should then meet the agricultural experts to decide what crops, including fruits and vegetables, should be grown to supply the missing elements. The approximate quantities needed should be indicated, and the agricultural staffs acting along with the rural development authorities should then encourage by all means in their power the growth of these crops."